

## WHAT IS CLAIMED IS:

- 1           1.       A method of forming a ferroelectric PZT film on a substrate,  
2       comprising:  
3           providing a premixed source reagent solution comprising a mixture of a  
4       lead precursor, a titanium precursor and a zirconium precursor in a solvent  
5       medium;  
6           vaporizing the source reagent solution to form a precursor vapor; and  
7           introducing the precursor vapor into a chemical vapor deposition chamber  
8       containing the substrate.
- 1           2.       The method of claim 1, wherein the zirconium precursor comprises  
2        $\text{Zr}(\text{OiPr})_2(\text{thd})_2$  or  $\text{Zr}(\text{thd})_4$  or  $\text{Zr}(\text{O}^i\text{Bu})_2(\text{thd})_2$ .
- 1           3.       The method of claim 1, wherein the lead precursor is  
2        $\text{Pb}(\text{thd})_2(\text{pmdeta})$ , the zirconium precursor is  $\text{Zr}(\text{OiPr})_2(\text{thd})_2$ , and the titanium  
3       precursor is  $\text{Ti}(\text{OiPr})_2(\text{thd})_2$ .
- 1           4.       The method of claim 1, wherein the lead precursor, the titanium  
2       precursor and the zirconium precursor have a combined concentration between  
3       about 0.05 M and about 1.0 M in solution.
- 1           5.       The method of claim 1, wherein the source reagent solution is  
2       characterized by lead, zirconium and titanium concentrations between about 5%  
3       and 95%.
- 1           6.       The method of claim 1, further comprising introducing into the  
2       chemical vapor deposition chamber an oxidizing co-reactant gas comprising 5-  
3       100%  $\text{N}_2\text{O}$ .
- 1           7.       The method of claim 6, wherein the oxidizing co-reactant gas  
2       comprises 50-75%  $\text{N}_2\text{O}$ .
- 1           8.       The method of claim 1, further comprising introducing into the  
2       chemical vapor deposition chamber an oxidizing co-reactant gas comprising one  
3       or more of the following gases:  $\text{N}_2\text{O}$ ,  $\text{O}_2$ , and  $\text{O}_3$ .

1           9.     The method of claim 1, further comprising:  
2           providing a second premixed source reagent solution comprising a second  
3     mixture of the lead precursor, the titanium precursor and the zirconium precursor  
4     in the solvent medium, wherein the first source reagent mixture is different from  
5     the second source reagent mixture;  
6           mixing the first and second reagent solutions to form a precursor solution;  
7     and  
8           vaporizing the precursor solution to form the precursor vapor.

1           10.    The method of claim 9, wherein the first and second source reagent  
2     solutions are characterized by a lead concentration in a range of about 28-65 %, a  
3     zirconium concentration in a range of about 14-29 %, and a titanium  
4     concentration in a range of about 20-43 %.

1           11.    The method of claim 1, wherein the solvent medium comprises an  
2     octane-based solvent.

1           12.    The method of claim 1, wherein the source reagent solution is  
2     vaporized at a temperature in the range of about 180-210° C.

1           13.    The method of claim 1, further comprising maintaining the chemical  
2     vapor deposition chamber at a pressure in the range of about 0.5-10 torr during  
3     deposition.

1           14.    The method of claim 13, wherein the chemical vapor deposition  
2     chamber is maintained at a pressure in the range of about 0.5-4 torr during  
3     deposition.

1           15.    The method of claim 14, wherein the chemical vapor deposition  
2     chamber is maintained at a pressure of approximately 4 torr during deposition.

1           16.    The method of claim 1, wherein the source reagent solution is  
2     selected to obtain a precursor vapor having a Zr/(Zr + Ti) ratio in the range of  
3     about 0.05-0.70.

1           17.    The method of claim 1, wherein the source reagent solution is  
2    selected to obtain a precursor vapor having a Pb/(Zr + Ti) ratio in the range of  
3    about 0.3-3.0.

1           18.    The method of claim 1, further comprising preheating the substrate  
2    during a preheating period.

1           19.    The method of claim 18, wherein the preheating period is about 5-  
2    30 seconds long.

1           20.    The method of claim 18, further comprising disposing the preheated  
2    substrate on a heated susceptor during a heating period prior to formation of the  
3    PZT film on the substrate.

1           21.    The method of claim 20, wherein the heating period is about 30-60  
2    seconds long or longer.

1           22.    The method of claim 1, further comprising providing a flow of a  
2    purge gas to reduce film depositions on susceptor and chamber wall surfaces.

1           23.    A method of forming a ferroelectric PZT film on a substrate,  
2    comprising:  
3           introducing a substrate into a chemical vapor deposition chamber;  
4           preheating the substrate during a preheating period;  
5           after the preheating period, disposing the substrate on a heated susceptor  
6    during a heating period;  
7           forming a precursor solution from a mixture of a lead precursor, a titanium  
8    precursor and a zirconium precursor in a solvent medium;  
9           vaporizing the precursor solution to form a precursor vapor; and  
10          introducing the precursor vapor into the chemical vapor deposition  
11    chamber to form a ferroelectric PZT film on the heated substrate.

1           24.    The method of claim 23, wherein the substrate is preheated by  
2    supporting the substrate above the heated susceptor during the preheating period.

1           25.    The method of claim 23, further comprising providing a flow of a  
2    purge gas to reduce film depositions on susceptor and chamber wall surfaces.